AN ANNOTATED BIBLIOGRAPHY ON APHELINUS MALI (HALD.), A PARASITE OF THE WOOLLY APPLE APHID

1851-1950

Compiled by
M. A. Yothers, Division of Fruit Insect Investigations

United States Department of Agriculture
Agricultural Research Administration
Bureau of Entomology and Plant Quarantine

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The woolly apple aphid (Eriosoma lanigerum (Hausm.)) is one of the most important enemies of the apple. It attacks the foliage, twigs, fruit, roots, and any wounds on the tree. Many control methods have been tried, including spraying, dusting, dipping, fumigation, the development of resistant rootstocks, and natural control by predators and parasites. The hymenopterous parasite Aphelinus mali (Hald.) is a highly effective parasite of the woolly apple aphid. Its use for the control of this pest has been significant in Oregon and Washington, where it was found to be largely responsible for the development of perennial apple canker (Gloeosporium perennans (Zeller and Childs)). The introduction and establishment of the parasite in these districts reduced both aphid and canker to a minimum.

Aphelinus mali is one of the most effective insect parasites. It is a native of North America, having been first described by Haldermann (1) in 1851. Since that time, but particularly during the period 1920-40, this parasite has been studied and introduced into most of the apple-growing regions of the world. In most of them it is giving more or less control of the woolly apple aphid, and considerable literature has grown up relating to it. This bibliography covers the literature from 1851 through 1950.

Most of the references were taken from the Review of Applied Entomology, Series A. A few were obtained from "A Biological Study of Aphelinus mali Hald., a Parasite of the Woolly Apple Aphid, Eriosoma lanigerum Hausm." Lundie (70); "Aphelinus mali and Its Travels" Howard (129); and from the bibliographies in other articles.

1/ Retired June 30, 1949. The compiler acknowledges much helpful cooperation from E. J. Newcomer of the Division of Fruit Insect Investigations, without which the work would not have been completed.

1851

Haldemann, S. S. (1)
Entomology, No. 4. Pa. Farm Jour. 1(5): 129-131, illus.

Eriophilus mali (original description of Aphelinus mali, with figure).

1859

Haldemann, S. S. (2)
(Aphelinus mali) Boston Soc. Nat. Hist. Proc. 6: 402-403.

Description reprinted from Haldemann (1) without figure.

1881

Howard, L. O. (3)
Report on the parasites of the Coccidae in the collection of this Department. U. S. Commr. Agr. Ann. Rpt. 1880: 350-373.

Aphelinus mali, p. 356. Included here as the only known North American member of the tribe Aphelinina not known to be parasitic upon a member of this family (Coccidae). Calls attention to the fact that Eriophilus is a synonym of Aphelinus.

1893

Webster, F. M. (4)
Notes on some species of Ohio Hymenoptera and Diptera heretofore undescribed. Ohio Agr. Expt. Sta. Tech. Ser. Bul. 1(3): 157-158.

Biological notes on Aphelinus mali. The male is reported, having heretofore been unknown.

1895

Howard, L. O. (5)
Revision of the Aphelininae of North America. U. S. Tech. Serv. Bul. 1: 1-44.

Redescribes Aphelinus mali and lists six species of aphids, including Schizoneura lanigera, as hosts.

1896

Stedman, J. M. (6)
The woolly-aphid of the apple or the apple-root plant-louse (Schizoneura lanigera (Hausm.)). Mo. Agr. Expt. Sta. Bul. 35: 36-61.

A minute chalcid fly, Aphelinus mali, is parasitic on the woolly apple aphid and could, in sufficient numbers, greatly diminish the numbers of aphids, but no case has been observed where this has actually happened. The fly is so small that it will escape the notice of the ordinary observer.

1908

Gillette, C. P. (7)
Notes and descriptions of some orchard plant lice of the family Aphididae. Jour. Econ. Ent. 1: 302-310.

"We have reared no parasite from it, but on Aug. 21, 1908, L. C. Bragg brought into my office a female Aphelinus mali (det. by L. O. Howard) busily ovipositing in apterous females of this louse (Eriosoma lanigerum)."

_____ and Taylor, E. P. (8)
A few orchard plant lice. Colo. Agr. Expt. Sta. Bul. 133: 13, 26, and 37.

Aphelinus mali discussed.

Howard, L. O. (9)
Upon the aphis-feeding species of Aphelinus. Ent. News 19: 365-367.

Contains a table of the species, including mali.

Smith, H. S. (10)
Aphis injurious in Nebraska during 1906-1907. Nebr. State Bd. Agr. Ann. Rpt.: 307-326.

Aphelinus mali, page 322.

1909

Anonymous (11)
(Aphelinus mali). N. J. State Museum Ann. Rpt. 1909: 640.

Parasitic on woolly apple, cabbage, and other plant lice.

Girault, A. A. (12)
A new chalcidoid of the eulophid genus Aphelinus Dalman, parasitic on Schizoneura crataegi Oestlund. Psyche 16: 29-31.

Describes Aphelinus vericornus (n. sp.) parasitic on S. crataegi. Probably a synonym for A. mali.

Silvestri, F. (13)
/Remarks on the present condition of agricultural entomology in the United States of North America and what Italian agriculture can learn./ Soc. degli Agr. Ital. Bol. 14(8): 305. /In Italian./

(English translation in Hawaii. Forester and Agr., Aug. 1909: 287-336.)

1911

Lohrenz, H. W. (14)
The woolly aphis, Schizoneura lanigera. Jour. Econ. Ent. 4: 162-170.

Several natural enemies were found to attack the aphid. One of the parasitic chalcid flies killed off large colonies in the spring, and for a while it was almost impossible to rear the aphid in the laboratory because the parasite had been introduced with stock from the nurseries. Aphelinus mali was not found in the summer or fall.

1912

Patch, Edith M. (15)
Elm leaf curl and woolly apple aphid. Maine Agr. Expt. Sta. Bul. 203: 252-253.

Quotes Gillette (8) on occurrence of Aphelinus in Colorado.

Webster, F. M., and Phillips, W. J. (16)
The spring grain-aphis or "green bug." U. S. Bur. Ent. Bul. 110, 153 pp.

Reports the parasite reared from various aphids, pp. 103, 122-125.

1913

Patch, Edith M. (17)
Woolly aphid of the apple (Schizoneura lanigera). Maine Agr. Expt. Sta. Bul. 217: 179.

Two days quest in the vicinity of Orono early in September 1913 failed to locate a single woolly apple aphid colony which was not well-nigh demolished by Aphelinus mali.

1914

Slingerland, M. V., and Crosby, C. R. (18)
Manual of fruit insects. 503 pp. Macmillan. New York.

Aphelinus mali, p. 157.

1916

Patch, Edith M. (19)
Elm leaf rosette and woolly aphid of the apple. Maine Agr. Expt. Sta. Bul. 256: 336.

A revision of Bul. 217 (17).

1918

Becker, Geo. G. (20)
The apple woolly aphis, Eriosoma lanigerum Hausm. Ark. Agr. Expt. Sta. Bul. 154: 11.

Aphelinus mali caused a high mortality of woolly apple aphids.

1920

Anonymous (21)
La lucha contra el pulgón del manzano. [Uruguay] Defensa Agr. Bol. Mens. 9: 207-208.

Preparatory measures are discussed for importing Aphelinus mali into Uruguay, where the woolly apple aphid is a dangerous pest to fruit trees.

Schurmann, G. B. (22)
Informe acerca del Aphelinus mali, parásito que ataca al pulgón lanígero. Montevideo Min. Indus. Rev. 8(52): 149-153.

The author concludes that the benefit from A. mali in North America and France is exaggerated and variable. He hopes to introduce it into Uruguay.

1921

Anonymous (23)

Departmental activities, November 1920: entomology 4. So. Africa Dept. Agr. Jour. 2(1): 14-16.

The introduction of Aphelinus mali into South Africa from North America is discussed.

_____ (24)

Departmental activities: entomology. So. Africa Dept. Agr. Jour. 2(2): 109-113.

Believes that the introduction of Aphelinus mali from the United States will become established.

_____ (25)

Departmental activities: entomology. So. Africa Dept. Agr. Jour. 2 (3): 204-206.

The success of Aphelinus mali is discussed.

_____ (26)

Departmental activities: entomology. So. Africa Dept. Agr. Jour. 2(4): 301-306.

The establishment of the parasite Aphelinus mali of the woolly apple aphid received a check, owing to the aphid almost dying out in February; with its reappearance in March, however, the parasites were found in numbers.

_____ (27)

Departmental activities: entomology, August 1921. So. Africa Dept. Agr. Jour. 3(4): 306-309.

The establishment of Aphelinus mali has not yet been proved. It is possible that its work is hindered by the coccinellids which probably reduce its food supply at a critical time, and may also devour freshly parasitized aphids.

_____ (28)

La difusión del Aphelinus mali. [Uruguay] Defensa Agr. Bol. Mens. 2(5): 121.

A. mali introduced into Uruguay.

1921

Anonymous (29)
El enemigo del pulgón del manzano. Travajos para su aclimatación. [Uruguay] Defensa Agr. Bol. Mens. 2(2): 39-41.

All the specimens of Eriosoma lanigerum imported from the United States were dead upon arrival, but from this material some living hymenopterous parasites, believed to be Aphelinus mali, have been obtained.

_____ (30)
Laboratoire de phytopathologie. Soc. Sci. Nat. du Maroc. 1(1): 22-27.

The woolly apple aphid in Morroco is not sufficiently abundant to justify the introduction of Aphelinus mali.

_____ (31)
Rapports sommaires sur les travaux accomplis dans les laboratoires et comptes rendus des missions d'études. Ann. des Épiphyt. 7(1919-20): 421-441.

Aphelinus mali introduced against Eriosoma lanigerum.

Hitier, H. (32)
Un parasite du puceron lanigère. Jour. d'Agr. Prat. 36(30): 101.

Attention has been directed for some time toward finding a parasite of E. lanigerum, which is so destructive to apple trees in France. Aphelinus mali has been introduced in small numbers from America, and has been very carefully propagated in special cages at various entomological stations. Results have been encouraging. Too much must not be expected, however, as the multiplication of the parasite in spring is slower than that of E. lanigerum; later in the season its activities may be of great benefit.

Marchal, P. (33)
Introduction en France de l'Aphelinus mali Haldemann, parasite du puceron lanigère. Rev. de Zool. Agr. et Appl. 20(7): 65-70.

A. mali, the chalcid parasite of Eriosoma lanigerum Hausm., has been imported from America and successfully established in various districts in France. Its general distribution over the country is considered only a matter of time. Under natural conditions hibernation occurs in the larval or pupal stage within the host larva. During 1921 the first adults emerged toward the end of March.

1921

Marchal, P. (34)
Introduction of Aphelinus mali Hald. into France. Rev. Hort. de l'Algérie 25(5): 94-96.

A brief account of the introduction of this parasite of the woolly apple aphid into France, beginning in the spring of 1919.

_____ (35)
Introduction of the woolly apple aphis parasite Aphelinus mali Hald. into France. Acad. d'Agr. de France Compt. Rend. 7(28): 619-625.

An account of the introduction of this parasite from the United States and its establishment in France.

_____ and Foex, E. (36)
Rapport phytopathologique pour les années 1919-1920. Ann. des Épiphyt. 7: 1-lxxxvii.

Eriosoma lanigerum was very abundant in the spring of 1920 in many districts, but finally almost disappeared, owing to the activities of its enemies. Further introductions of Aphelinus mali as a means of controlling this pest are to be made.

Sundberg, R., and Peluffo, A. T. (37)
La importación del Aphelinus mali al Uruguay para combatir el pulgón del manzano y algunas observaciones realizadas sobre la vida del insecto auxiliar. /Uruguay/ Defensa Agr. Bol. Mens. 2(3): 65-81.

Reports biological data on the introduction and establishment of A. mali into Uruguay from the United States to combat the woolly apple aphid.

Tillyard, R. J. (38)
The introduction into New Zealand of Aphelinus mali, a valuable parasite of the woolly aphis. New Zeal. Dept. Agr. Jour. 23 (1): 7-19.

Parasitized woolly apple aphids were shipped from the United States to Wellington, New Zeal. Material was collected from several locations to insure a good mixed strain. The parasites were reared in a cage and all hyperparasites possible were eliminated before the A. mali were liberated on the trees. The 3

1921

males and 2 females that survived were placed on an apple tree and increased to at least 142 individuals by the end of summer. Emergence was noticeably affected by sudden drops in temperature. It is planned to stock the whole of New Zealand within 2 years, if winter mortality is not too heavy and if satisfactory methods of handling are developed.

Trouvelot, B. (39)
Observations biologiques sur l' Habrobracon johansenni Vier. Soc. de Biol. [Paris] Compt. Rend. 85(35): 1022-1024.

The adult H. johansenni pierces the body of the larva of the potato tuber moth, Gnorimoschema operculella (Zell.), and sucks the juice that exudes from the puncture, as does Aphelinus mali when attacking Eriosoma lanigerum.

1922

Anonymous (40)
Departmental activities: entomology. So. Africa Dept. Agr. Jour. 4(2): 114-117.

Aphelinus mali still surviving near Pretoria and Ventersdorp but will probably not prove of much importance, owing to the unfavorable climate.

(41)
Departmental activities: entomology. So. Africa Dept. Agr. Jour. 4(4): 300-304.

Aphelinus mali increased in Pretoria in midsummer. Can be introduced by transferring a few twigs, but this method may spread the San Jose scale.

(42)
Departmental activities: entomology. So. Africa Dept. Agr. Jour. 4(5): 399-401.

Aphelinus mali is apparently established near Pretoria and it is hoped that its introduction into Natal will be successful.

1922

Brèthes, J. (43)
Sección entomológica. Inst. Biol. Soc. Rural Argentina Mem. Trab., 1921-22: 40-43.

Aphelinus mali promises to be very successful against the woolly apple aphid.

Hartley, E. A. (44)
Some bionomics of Aphelinus semiflavus (Howard) chalcid parasite of aphids. Ohio Jour. Sci. 22(3): 209-236.

"Aphelinus mali was long considered an exception (as a parasite of aphids only) appearing many times in records as a scale parasite, but Dr. Howard now believes this to be an error, and considers that it is probably confined to aphids, and perhaps only to the woolly forms, especially Eriosoma lanigerum Hausm."

Matus, M. D. (45)
El pulgón de los manzanos (Schizoneura lanigera Hausm.). Su destrucción por medio de la lucha biológica con el Aphelinus mali (Hald.). Experimentaciones realizades por el instituto biológico de la sociedad rural Argentina. Soc. Rural Argentina An. 56(24): 720-723; Gac. Rural [Buenos Aires] 16(185): 463-467.

The establishment of A. mali into Argentina seems promising.

Tillyard, R. J. (46)
Progress of the work of breeding and distribution of Aphelinus mali in New Zealand. New Zeal. Dept. Agr. Jour. 25(1): 31-34.

Trees were prepared in cages upon which to rear Eriosoma lanigerum and its parasite the following summer. Trees were left unsprayed. Nearly 3,000 parasites had been distributed to various places from the central distributing center at the Cawthorn Institute, Nelson.

Trujillo Peluffo, A. (47)
El Aphelinus mali. Su envío al extranjero. [Uruguay] Defensa Agr. Bol. Mens. 3(8): 114-116.

Since its introduction into Uruguay early in 1921, A. mali has effectively controlled the woolly apple aphid. In 1922 this parasite was sent to Argentina, England, Italy, and Chile.

1922

Wille, J. (48)
Die biologische Bekämpfung der Blutlaus in Uruguay. Nachrichtenbl. f. den Deut. Pflanzenschutzdienst 2(2): 10-11.

Discusses the introduction of Aphelinus mali into Uruguay to control Eriosoma lanigerum.

1923

Anonymous (49)
Report on the work of the entomological stations of Paris and the south of France for the year 1922. Ann. des Épiphyt. 9(6): 443-463.

Aphelinus mali was reared at the Mentone station.

_____ (50)
Departmental activities: entomology. So. Africa Dept. Agr. Jour. 6(4): 288-290.

In February a high percentage of the woolly apple aphid was attacked by the recently introduced Aphelinus mali.

_____ (51)
La defensa agricola en el extranjero. Éxito de los envíos de insectos auxilares. [Uruguay] Defensa Agr. Bol. Mens. 4 (5-6): 57-58.

Aphelinus mali was established in Uruguay. Shipments were sent to Italy and Germany.

Brèthes, J. (52)
Sección entomología. Inst. Biol. Soc. Rural Argentina, Mem. Mayo 1922-23: 37-44

Aphelinus mali introduced from Uruguay for the control of the woolly apple aphid has surpassed expectation.

Crouse, F. L. (53)
La acción del Aphelinus mali en Chile. [Uruguay] Defensa Agr. Bol. Mens. 4(7-8): 79.

Excellent results have been obtained in Chile with A. mali, imported from Uruguay against the woolly apple aphid.

1923

Del Guercio, Giacomo (54)
Sulla introduzione e diffusione della vespina nera (Aphelinus mali Hald.) in Italia per la distruzione della schizoneura del melo. R. Soc. Toscana di Ortio. Bul. 48(5-8): 17-24.

Discusses the introduction of A. mali into Italy from France in September 1921 and subsequently.

Guignon, J. H. (55)
L' Aphelinus mali parasite du puceron lanigère (Myzoxylus mali Hausm.). Rev. d' Hist. Nat. Appl., Ière pt. 4(3): 67-71

A. mali, a parasite of Eriosoma lanigerum, has recently been liberated in the Seine and Marne districts, where it is hoped it will become established.

Jarvis, H. (56)
Fruit-fly investigations. Queensland Agr. Jour. 20(5): 369-371.

Detailed account of the liberation of Aphelinus mali received from New Zealand.

Malenotti, E. (57)
Brevi note sull' Aphelinus mali Hald. Reprint, 8 pp. from Vincentina, (9), Vicenza.

Aphelinus mali obtained from France and Uruguay has established itself in the neighborhood of Vicenza. Also parasitizes the pear aphid (Eriosoma pyricola).

_____ (58)
Per una più rapida diffusione dell' Afelino del melo. Reprint, 3 pp. from Il Contadino della Marca Trivigiana.

Discusses the recent introduction of Aphelinus mali into Venetia and the best methods of effecting its spread.

Matus, M. D. (59)
La lucha biológica contra el pulgón de los manzanos. Gac. Rural [Buenos Aires] 17(195): 229-235.

The use of Aphelinus mali against Eriosoma lanigerum in Argentina. Apples should be grafted on stocks resistant to the aphid, so that the subterranean parts of the plants remain free from infestation, in order that the work of the parasite above ground may prove successful.

1923

Régnier, R. (60)
De quelques grands ennemis du pommier et de leurs parasites. Rev. Appl. Bot. and Agr. Colon. 3(19): 169-185.

Reports the introduction of Aphelinus mali into France.

Riesle, P. R. (61)
El pulgón lanigero del manzano, su tratamiento y estudios hechos en Chile para combatirlo (Eriosoma lanigera). Agronomia 13 (2): 62-67.

Natural enemies, such as Aphelinus mali, which has been recently imported into Chile, and syrphid and Coccinellid larvae, are not checking the infestation of fruit trees by E. lanigerum, and recourse must be had to spraying.

Tillyard, R. J. (62)
The parasite of the woolly aphis in New Zealand. Progress of work of distributing Aphelinus mali during the season 1922-23. 8 pp. s.l.

The introduction and establishment of A. mali in New Zealand is reported in detail.

1924

Anonymous (63)
Entomologie. Trav. Soc. Agr. France Compt. Rend. 55: 157-159.

Discusses the value of Aphelinus mali.

Bolle, J. (64)
Ein Feind der Blutlaus des Apfelbaumes. Ztschr. Angew. Ent. 10(2): 463-465.

Discusses the use of Aphelinus mali against Eriosoma lanigerum in Italy.

French, C., Jr., and Pilloud, L. (65)
Control of woolly aphis. Victoria Dept. Agr. Jour. 22(12): 725-727.

Aphelinus mali has been introduced into Victoria from New Zealand.

1924

Hodson, W. E. H., and Beaumont, A. (66)
First annual report of the Department of Plant Pathology for the year ending Sept. 30, 1924. Seale-Hayne Agr. Col. Pam. 16, 31 pp.

Aphelinus mali was released in Cornwall early in May, and parasitized clusters of the woolly apple aphid were found from the end of August at some distance from the points of introduction.

Jarvis, H. (67)
Fruit fly investigation. Queensland Agr. Jour. 21(5): 382-385.

Aphelinus mali is established in at least one orchard and a further supply is awaited.

_____ (68)
Fruit fly investigation. Queensland Agr. Jour. 22(6): 435-438.

Distribution of Aphelinus mali is being continued.

Lounsburg, C. P. (69)
Report of the Division of Entomology, 1923-24. So. Africa Dept. Agr. Jour. 9(6): 556-567.

The introduction of Aphelinus mali from America has proved unsatisfactory, owing to prolonged drought and heat of early summer.

Lundie, A. E. (70)
A biological study of Aphelinus mali Hald., a parasite of the woolly apple aphid, Eriosoma lanigerum Hausm. N. Y. (Cornell) Agr. Expt. Sta. Mem. 79 pp. 3-27.

The first comprehensive biological study of A. mali. Presents life history, habits, methods of rearing, oviposition, longevity, parthenogenesis, number of generations, hibernation, and bibliography.

Malenotti, E. (71)
Prospaltella berlesei e Aphelinus mali. Gior. di Agr. della Domenica 34(25): 226.

Discusses differences in behavior between the two parasitic chalcids, P. berlesei and A. mali.

1924

Malenotti, E. (72)
Un "araba fenice" a Lendinara. Coltivatore e Gior. Vinio. Ital. 70(28): 303-304.

This paper refers to the "afelino del melo" and is referred to by Howard (129) p. 361.

_____ (73)
Una migrazione dell 'afelino a 12 chilometri. Coltivatore e Gior. Vinio. Ital. 70(35): 518-520.

The parasite was found 12 kilometers (7 miles) from a point of liberation. Considered this distribution largely a matter of wind spread.

Meyer, R. (74)
Die Einführung des Blutlausparasiten Aphelinus mali Hald., in Deutschland. Nachrichtenbl. f. den Deut. Pflanzenschutzdienst 4(2): 9.

Reports the introduction of A. mali from Uruguay and its establishment in Germany.

Newman, L. J. (75)
Report of economic entomologist. West. Austral. Dept. Agr. Ann. Rpt., 1923-24: 20-24.

Aphelinus mali reported as bred from the black orange aphid (Aphis tavaresi).

_____ (76)
Woolly aphis parasite, Aphelinus mali Hald. West Austral. Dept. Agr. Jour. 2 Ser. 1(1): 40-44. Leaflet 128, 6 pp.

Records the successful introduction of A. mali into western Australia where the woolly apple aphid thrives particularly well in the southwest and southern apple country.

_____ (77)
Woolly aphis parasite (Aphelinus mali). West Austral. Dept. Agr. Jour. 1(4): 481-482.

A. mali is introduced into various localities in New Zealand.

266758 O—53—3

1924

Régnier, R. (78)
The acclimatization in Normandy of Aphelinus mali.

Exact reference not available. See Howard (129) pp. 353-356.

Tillyard, R. J.
The parasite of the woolly aphis in New Zealand. Progress of work of distributing Aphelinus mali during the season 1923-24. New Zeal. Fruitgrower and Apiarist Sept. 7 pp. Reprint. (79)

Discusses continued work with A. mali in New Zealand. Material from New Zealand has been sent to the Transvaal.

1925

Anonymous (80)
Reports on the work of the entomological stations in France for the year 1925. Ann. des Épiphyt, 11(6): 471-485.

Reports the continuation of rearing and distribution of Aphelinus mali against the woolly apple aphid.

Fryer, J. C. F., et al. (81)
Insect pests of crops in England and Wales, 1922-24. [Gt. Brit.] Min. Agr. and Fisheries, Misc. Pub. 49, 35 pp.

Aphelinus mali had been introduced from France to combat the woolly apple aphid.

Del Guercio, G. (82)
Nuova contribuzione allo studio della Schizoneura del melo e del suo nemico endofago Aphelinus mali Hald. var. italica Del Guercio. Inst. Agr. Colon. Ital. 36 pp.

A summary on the study of the woolly apply aphid and its control in Italy.

_____ (83)
Il pidocchio lanigero del melo ed il suo nemico endofago, Aphelinus mali Hald. var. italica Del Guercio. L'Agr. Colon 19(3-7): 98-104, 121-128, 179-183, 218-225, 254-264.

Gives the same information as in (82).

1925

Jarvis, H. (84)
Apple tree woolly aphis and its subjugation by Aphelinus mali Hald. Queensland Agr. Jour. 23, pt. 4: 314-316.

A. mali introduced and established in Queensland with remarkable success. Parasite found 3 miles from point of liberation. It is hoped the parasite will also attack aphids on citrus and banana.

_____ (85)
Fruit fly investigations. Queensland Agr. Jour. 23, pt. 3: 185-187.

Aphelinus mali used against the woolly apple aphid.

_____ (86)
Fruit fly investigations. Queensland Agr. Jour. 24(1): 60-62.

Overwintering of Aphelinus mali.

Levick, G. T. (87)
The woolly aphis parasite (Aphelinus mali). Victoria Dept. Agr. Jour. 23(3 & 6): 171-173, 363-366.

Reports recent introduction and complete establishment in Victoria from New Zealand. Reviews the work in New Zealand.

Makgill, R. H. (88)
The pear-midge pest. Spraying experiments at Henderson. New Zeal. Dept. Agr. Jour. 30(4): 224-228.

Spraying to control the woolly apple aphid rendered unnecessary by the introduction of Aphelinus mali.

Morstatt, H. (89)
Weitere Mitteilungen über Aphelinus mali Hald. Anz. f. Schädlingsk. 1(9): 106-107.

The same information given by Stenton (92).

Nicholls, H. M. (90)
Annual report of the government microbiologist. Tasmania Agr. and Stock Dept. Rpt. 1924-25, 4 pp.

Reports the introduction of Aphelinus mali on apple twigs infested with Eriosoma lanigerum from western Australia and the rapid reduction of the aphid by the parasite.

1925

Schander, R., and Kaufmann, O. (91)
Einführung des Blutlausparasiten Aphelinus mali (Hald.) nach Deutschland. Ztschr. f. Angew. Ent. 11(3): 386-394.

Reports the introduction of A. mali into Germany from Uruguay and gives observations of its biology and possible efficiency.

Stenton, R. (92)
Introduction of a parasite of the woolly aphis. [Gt. Brit.] Min. Agr. and Fisheries 32(4): 343-349.

Reports the introduction of Aphelinus mali into England from France in March 1923 and its establishment.

Tillyard, R. J. (93)
Aphelinus mali. Distribution of the parasite of the woolly aphis in New Zealand during the season 1924-25. New Zeal. Fruit-grower and Apiarist, June, 4 pp. Reprint.

The distribution of A. mali, in New Zealand has been continued, and a record number was sent to all parts of the Dominion. A. mali has been found at distances of 3 to 7 miles from the nearest liberation point, and no doubt it is maintaining itself under normal orchard conditions and is extending its range wherever its host is available.

Trouvelot, B. (94)
Objectives à suivre dans l' importation pur les besions de l' agriculture d' insectes entomophages etrangers. Rev. de Zool. Agr. et Appl. 24(6-7): 125-140, 141-148.

Discusses the acclimatization of Aphelinus mali in different regions (p. 132).

Van Poeteren, N. (95)
Verslag over de Werkzaamheden van den Plantenziektenkundigen Dienst in het Jaar 1924. Verslag. en Meded. Plantenziektenkund. Dienst Wageningen. 41, 62 pp.

Aphelinus mali was introduced into Holland in 1924, but it remains to be seen whether it can survive the damp climate.

1926

Anonymous (96)
Departmental activities: entomology. So. Africa Dept. Agr. Jour. 12(3): 195-201.

Aphelinus mali is found abundantly in the Orange Free State, although it has never been introduced into this region.

Blanchard, E. E. (97)
Aphid notes. Part 6. Argentine species of the subtribes Callipterina, Pterochlorina, and Lachnina, and of the tribes Eriosomatini and Phemphigini. Physis 8(30): 324-337.

The importance of Eriosoma lanigerum has been much reduced by the introduction of Aphelinus mali.

Essig, E. O. (98)
Insects of western North America. MacMillan Company, New York, 1,035 pp.

Aphelinus mali (p. 828) occurs throughout the United States and ranges into the Southwestern States. Parasitic on Brevicoryne brassicae (L.), Toxoptera graminum Rond., Macrosiphum rosae (L.), Eriosoma lanigerum (Hausm.), Prociphilus fraxinifolii (Riley), and other Aphididae.

Gurney, W. B. (99)
The woolly aphis parasite (Aphelinus mali (Hald.)). Agr. Gaz. N. S. Wales 37(8): 620-626.

A general account of the introduction of the parasite of Eriosoma lanigerum from New Zealand into Australia, together with the methods employed in the initial introduction, and a note of its life history.

(100)
Distribution of the parasite Aphelinus mali. Agr. Gaz. N. S. Wales 37(2): 162.

Describes the distribution of approximately 16,000 live individuals of A. mali in New South Wales, with full instructions on methods of their release.

1926

Gurney, W. B., and Le Gay Brereton, W. (101)
The control of woolly aphis. Methods that are available. Agr. Gaz. N. S. Wales 37(7): 545-551.

Describes the successful establishment of Aphelinus mali in New Zealand. Arsenical sprays have little effect on it, but when introduced on a few trees in an orchard these trees should be left unsprayed, so that an aphid population can be built up for the parasite to work on. Prunings of trees showing dead, parasitized aphids should be kept, to start fresh colonies of the parasite in the spring.

Hodson, W. E. H., and Beaumont, A. (102)
Second annual report of the Department of Plant Pathology for the year ending September 30, 1925. Seale-Hayne Agr. Col. Pam. 19, 32 pp.

Aphelinus mali, introduced into an orchard in Cornwall in 1924, persisted in 1925, but did not increase appreciably and failed to control the woolly apple aphid.

Jarvis, H. (103)
Fruit fly and other orchard pests in the Stanthorpe district. Queensland Agr. Jour. 25(1): 10-13.

Aphelinus mali has appeared in some of the orchards in which it was introduced against the woolly apple aphid in 1924-25. The first adults after the winter appeared in August. Attempts are being made to utilize this parasite against the black citrus aphid (Toxoptera aurantii (Fonsc.)) and the black peach aphid (Myzus sp.).

Krasucki, A. (104)
/Eriosoma (Schizoneura) lanigerum Hausm. in South-East Poland./ Choroby i Szkodniki Roślin 1(1925)(4): 22-30. /In Polish, with a summary in German./

The importation of Aphelinus mali from France is recommended.

1926

Lounsbury, C. P. (105)
/Report of the chief, Division of Entomology, 1925-26./ Farming in So. Africa 1(9): 334-338.

Reports the natural spread of Aphelinus mali, except in the Cape Peninsula, where climatic conditions seem to retard its establishment. The parasite is ineffective in spring, but may control the woolly apple aphid by midsummer and so check it in seasons and places where the heat has not killed the aphids naturally.

Newman, L. J. (106)
Aphelinus mali. West Austral. Dept. Agr. Jour. 3(4): 486-487.

Reports the introduction of A. mali to control the black citrus aphid (Siphonophora sp.) in western Australia. After the first year the outbreak of the aphid had entirely subsided and practically every aphid had been parasitized. From these trees many colonies were distributed elsewhere. (Howard considers this a wrong determination of the aphid.)

Nonell Comas, Jaime (107)
Estación de Patología Vegetal de Barcelona. Bol. de Patol. Veg. y Ent. Agr. 1(3): 109-110.

Aphelinus mali, introduced at Barcelona from Italy and Uruguay, was successfully established against the woolly apple aphid.

Theobald, F. V. (108)
Entomological department. Southeast. Agr. Col. Res. and Adv. Dept. Ann. Rpt. 1925-26: 5-22.

Reports the introduction and establishment of colonies of Aphelinus mali.

Tillyard, R. J. (109)
The progress of economic entomology in Australia and New Zealand. New Zeal. Dept. Agr. Jour. 32 (3-4): 173-181; 236-242.

Discusses the introduction and establishment of Aphelinus mali in New Zealand.

1926

Trouvelot, B. (110)
Les récents progrès de l'entomologie appliquée à l'agriculture en Italie. Soc. d'Encouragement pour. Indus. Nat. Bul., October 1926: 672-706.

Mentions the importation of natural enemies of coccids and of Aphelinus mali against the woolly apple aphid in Italy.

Van Poeteren, N. (111)
Verslag over de Werkzaamheden van den Plantenziektendundigen Dienst het Jaar 1925. Verslag en Meded. Plantenziektenkund. Dienst Wageningen 44, 124 pp.

Reports the survival of Aphelinus mali through the winter of 1924-25 in the Netherlands.

Veitch, R. (112)
Report of the chief entomologist. Queensland Dept. Agr. and Stock Ann. Rpt. 1925-26: 135-138.

Reports much benefit from the control of the woolly apple aphid by Aphelinus mali.

1927

Fisher, R. C. (113)
Recent work in France on the parasitic control of insects. Gard. Chron. 81(2089): 34-36.

A brief account of the establishment of the parasitic laboratory at Hyères, in southern France, by the U. S. Bureau of Entomology for the export of beneficial insects to the United States. Reports the successful establishment of Aphelinus mali in southern France and in Italy, but it has not done so well in the north.

Hodson, W. E. H., and Beaumont, A. (114)
Third annual report of the Department of Plant Pathology for the year ending September 30th 1926. Seale-Hayne Agr. Col. Pam. 21, 25 pp.

Since earlier attempts in establishing Aphelinus mali were not entirely successful, another attempt was made. Parasites were reared under glass and successive generations released. The parasite appears to be established now in three localities.

1927

Nonell Comas, Jaime (115)
Estación de Fitopatología Agrícola de Barcelona. Bol. de Patol. Veg. y Ent. Agr. 2(8-9): 168-170.

Aphelinus mali was introduced at Barcelona from Italy and Uruguay in June 1926. The acclimatization and distribution has proceeded satisfactorily in Spain.

Paoli, G. (116)
Casi fitopatologici osservati in Liguria nella primavera-estate 1927. [Italy] R. Staz. Patol. Veg. Bol. 7(4): 382-387.

Aphelinus mali, introduced into Liguria in 1923, has become acclimatized and is fairly effective in controlling the woolly apple aphid.

Theobald, F. V. (117)
Entomological department. Southeast. Agr. Col. Res. and Adv. Dept. Ann. Rpt. 1926-27: 16.

Aphelinus mali does not appear to be of any value in Kent, where it has been released.

Torres Ortiz, J. (118)
Estudio biológico sobre el Aphelinus mali. Agronomia 17(3): 106-108.

A brief biological study.

Veitch, R. (119)
Report of the chief entomologist. Queensland Dept. Agr. Rpt. 1926-27: 69-73.

Aphelinus mali continues to control the woolly apple aphid.

Wahl, B. (120)
Der Pflanzenschutz in Oesterreich. Deut. Gesell. f. Angew. Ent. Verhandl. 6; Mitgliederversamml.: 67-78.

The establishment of Aphelinus mali to control the woolly apple aphid has been attempted.

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1928

Benlloch, M. (121)
Estudios sobre nuevas fórmulas insecticidas o modificacion de las usuales. Bol. de Patol. Veg. y Ent. Agr. 3(12-14): 131-137.

Although Aphelinus mali destroys considerable numbers of the woolly apple aphid, contact sprays will be necessary to keep this aphid under control in some parts of Spain. Studies of new insecticide formulas or modifications of standard ones.

Faes, H. (122)
Un contre- parasite du puceron lanigère l' Aphelinus mali. Ann. Agr. de la Suisse 29(5): 515-519.

An account of the introduction and establishment of A. mali in Switzerland. Biological notes and methods of introduction are given.

Fryer, J. C. F., et al. (123)
Report on the occurrence of insect pests on crops in England and Wales, 1925-27. [Gt. Brit.] Min. Agr. Misc. Pub. 62, 47 pp.

Reports further attempts to introduce Aphelinus mali into the British Isles, but, owing to irregular occurrence of the host and the fact that the parasite emerges in the spring before any aphids are present, its usefulness will be limited.

Hodson, W. E. H., and Beaumont, A. (124)
Fourth annual report of the Department of Plant Pathology for the year ending September 30, 1927. Seale-Hayne Agr. Col. Pam. 25, 29 pp.

Details are given of the liberation of Aphelinus mali for the control of Eriosoma lanigerum. Winter spraying destroyed the parasite in one orchard where it had become established, but in an unsprayed orchard it passed the winter well.

Sprengel, L. (125)
Untersuchungen über den Blutlausparasiten Aphelinus mali Hald. Anz. f. Schädlingsk. 4(12): 151-160.

Reports on the rearing and establishment of A. mali against the woolly apple aphid. It is successfully established in the Rhine Palatinate.

1928

Van Poeteren, N. (126)
Verslag over de Werkzaamheden van den Plantenziektenkundigen Dienst in het Jaar 1926. Verslag. en Plantenziektenkund. Dienst Wageningen. 51, 100 pp.

Reports the continuation of rearing of Aphelinus mali and its distribution.

_____ (127)
Vraagstukken in verband met ziektebestrijding in de fruitteelt. Tijdschr. over Plantenziekten. 34(8): 211-229.

The introduction of Aphelinus mali into Holland in 1926 in 80 fruit-growing localities has not yet given rise to large colonies.

1929

Anonymous (128)
The breeding of beneficial parasites. Science 41(1780): 152.

An account of the work of the laboratory for rearing beneficial parasites, recently established in England by the Empire Marketing Board and under the control of the Imperial Bureau of Entomology. This laboratory sent consignments of Aphelinus mali to India and Kenya.

Howard, L. O. (129)
Aphelinus mali and its travels. Ent. Soc. Amer. Ann. 22(3): 341-368.

The history of A. mali, the North American parasite of the woolly apple aphid, is discussed, as well as its introduction into various parts of the world.

Jancke, O. (130)
Zur Frage der Ueberwinterung der Blutlaus und ihres Parasiten Aphelinus mali Hald. Nachrichtenbl. f. den Deut. Pflanzenschutzdienst 9(10): 83-85.

Twigs infested with woolly apple aphid parasitized by A. mali were placed on apple in the open at Naumburg in the autumn of 1928, and in April and June 1929 the parasite was found to have survived the very severe winter.

1929

Malenotti, E. (131)
Esperienze di fumigazioni in Alto Adige. Ital. Agr. 46(1): 37-45.

Owing to the cold winters and the rainy summers, Aphelinus mali did not control the woolly apple aphid. It withstands fumigation if still within its host.

Marchal, P. (132)
Les enemis du puceron lanigère, conditions biologiques et cosmiques de sa multiplication. Traitements. Ann. des Épiphyt. 15(3): 125-181.

An account, mostly taken from the literature, of the introduction and establishment of Aphelinus mali from North America in 1920 and 1921, and its spread and distribution in France up to 1928. It also gives notes on its distribution in various parts of the world, with notes on its biology. Records of its occurrence in other species of aphids than Eriosoma lanigerum are probably due to misidentification.

Régnier, R. (133)
État actuel de la question de l' acclimatation de l' Aphelinus mali, parasite américain du puceron lanigère. Assoc. Franc. Pomol., 6 pp.

States that the climate in Normandy, northern France, and England is not so favorable for the establishment of A. mali as that of the Mediterranean region, which is more like the climate in the United States. Suggests that a race might, by selective breeding, be reared that would appear later in the spring, when a more plentiful supply of its host is available.

Venables, E. P. (134)
Observations on the woolly aphis of the apple, Eriosoma lanigerum (Hausm.). Brit. Columbia Ent. Soc. Proc. (26): 28-33.

Recommends introduction of Aphelinus mali into British Columbia to control the woolly apple aphid. This aphid is the main cause of the spread of perennial canker disease of the apple.

1930

Anonymous (135)
(Aphelinus mali.) Oreg. Agr. Expt. Sta. Bien. Rpt. 1929-30: 16, 17, 86-90, 126-128, 138, 139. U. S. Dept. Agr. Expt. Sta. Rec. 64: 355.

Refers to the introduction of A. mali into the Hood River, Oreg. district in the fall of 1928 from Michigan, and states that it has become well established and has survived two winters.

_____ (136)
The Entomological Branch. Canada Min. Agr. Rpt., 1929-30: 128-150.

Aphelinus mali was liberated against Eriosoma lanigerum.

Childs, L., and Gillespie, D. G. (137)
Notes on the introduction of the woolly apple aphid parasite, Aphelinus mali. Jour. Econ. Ent. 23: 790-794.

Discusses in some detail the introduction and establishment of Aphelinus mali in the Hood River district of Oregon in 1928 with material from Michigan.

Cooley, R. A. (138)
Montana insect pests for 1929 and 1930. Montana Agr. Expt. Sta. Bul. 238, 23 pp.

States that Aphelinus mali is to be introduced to control the woolly apple aphid, which is particularly injurious in the Bitter Root Valley.

Howard, L. O. (139)
A history of applied entomology. Smithsn. Inst. Misc. Collect. 84, 564 pp.

Mentions (pp. 504-506) the distribution of Aphelinus mali from the United States to France, and from France or the United States to England, Switzerland, Germany, Italy, New Zealand, Australia, South Africa, Uruguay, Argentina, and Chile. It has been especially effective in New Zealand and Australia. Refers (p. 505) to the work of Trouvelot (94) in 1925, and states that since his publication A. mali has been taken with success to many different countries and different life zones. Mentions acclimatization in France (p. 507), introduction into Argentina (p. 510), and introduction in Australia

by Tillyard. Mentions P. Marchal's account of it in France (p. 516), and attempts by Kato to get it established in Japan (p. 520) which probably failed. Cites Tillyard's discussion of its introduction into New Zealand (p. 521). Mentions that it was sent to South Africa by Lundie in 1920 (p. 524), introduced from Germany into Switzerland (p. 525), also sent to India and Kenya from Farnham Royal, England, in 1928 (p. 531).

Howard, L. O. (140)
Aphelinus mali in Brazil. Jour. Econ. Ent. 23: 286.

Reports that A. da Costa Lima, of the Oswaldo Cruz Institute at Rio de Janeiro, recorded the introduction and successful establishment in Brazil.

Jardine, J. T. (141)
Director's biennial report. Oreg. Agr. Expt. Sta. Bien. Rpt., 1928-30: 127.

Introduction and investigation of the woolly apple aphid parasite, Aphelinus mali.

Kalandadze, L. (142)
Zur biologie der Blutlaus Schizoneura lanigera (Hausm.). Vorläufige Mitteilung. Anz. f. Schädlingsk. 6(1): 3-6.

Natural enemies of the woolly apple aphid in the Palatinate included the introduced parasite, Aphelinus mali, which appeared more promising than others.

Magarinos Torres, A. F. (143)
Aphelinus mali (Hald.). Chácaras e Quintaes 41(4): 343-345.

A list is given of the countries into which A. mali has been introduced since 1920, together with the results obtained. It was introduced into Brazil in 1923, and is reported to have controlled the woolly apple aphid in the State of Rio Grande do Sul.

Menzel, R. (144)
Konferenz betreffend die Bekämpfung von Krankheiten und Schädlingen der Obstbäume. Schweiz. Ztschr. f. Obst u. Weinbau 39 (1, 2): 4-69.

Records the introduction into Wädenswil from Tyrol of Aphelinus mali. The parasite withstood minimum winter temperatures of 14.8° F. below zero.

1930

Sprengel, L. (145)
Stand der Kenntnisse über die biologische Bekämpfung der Blutlaus (Eriosoma lanigerum Hausm.) mit Aphelinus mali Hald., in Europa. Gartenbauwissenschaft 4(1): 11-37.

A history is given of the introduction of A. mali into various countries in Europe during the past 40 years. Notes are also given on the biology of the parasite, together with methods for its liberation.

Van Poeteren, N. (146)
Verslag over de Werkzaamhenden van den Plantenziektenkundigen Dienst in het Jaar 1929. Verslag. en Meded. Plantenziektenkund. Dienst Wageningen. 62, 142 pp.

Aphelinus mali survived the very severe winter of 1928-29.

Veitch, R. (147)
Reports of the chief entomologist. Queensland Dept. Agr. Ann. Rpt., 1928-29: 67-71; 1929-30: 65-66.

Aphelinus mali continues to check the woolly apple aphid.

1931

Baird, A. B. (148)
Biological control of insect pests with special reference to vegetable insects. Ontario Veg. Growers' Assoc. Ann. Rpt. 26: 39.

Aphelinus mali mentioned.

Del Geurcio, G. (149)
La vespina che libera il pomario della Schizoneora del melo e del pero e salva diecine di milioni all' economia nazionale (Aphelinus mali Hald.) Redia 19: 253-307.

Discusses the various forms of the woolly apple aphid, Eriosoma lanigerum (Hausm.). The establishment of its parasite, Aphelinus mali, saves Italy many millions of lire.

Feytaud, J. (150)
Rapports sommaires sur les travaux accomplis dans les laboratoires en 1930. Ann. des Épiphyt. 17(1): 62-112.

The Bordeaux station has successfully disseminated Aphelinus mali against the woolly apple aphid.

1931

Glendenning, R. (151)
The progress of parasite introduction in British Columbia. Ent. Soc. Brit. Columbia Proc. 28: 29-32

Aphelinus mali, introduced into British Columbia in 1922, has survived but has not completely controlled its host.

Massee, A. M. (152)
Notes on mites and insect pests. East Malling [Kent] Res. Sta. 16th-18th Ann. Rpt., 1928-30, pt. 2 (sup.): 189-201.

Unsuccessful attempts to establish Aphelinus mali in 1925, 1927, and 1928 are discussed. Further attempts in 1929 were successful, the parasite becoming established in 1930 in original and neighboring orchards.

Menzel, R. (153)
Beobachtungen über das diesjährige Verhalten des Blutlausparasiten Aphelinus mali. Schweiz. Ztschr. f. Obst. u Weinbau 40(5-6): 117-119.

A. mali survived the winter of 1929-30 in Switzerland, as it had the preceding winter, and parasitism of 100 percent was observed in 1930.

Ripper, W. (154)
Die Blutlauszehrwespe in Welschtirol (Aphelinus mali Hald.). Neuheit. auf dem Geb. des Pflanzenschutz., 1931(4): 97-99.

A. mali has completely elimated the woolly apple aphid in the Bozen district, where it had been very severe. It entered Bozen from Venetia in 1925 by flying across the river Etsch. Abundant rainfall retards the establishment of the parasite.

Sprengel, L. (155)
Uber zwei hyperparasiten von Aphelinus mali Hald. Anz. f. Schädlingsk., 7(11): 130.

Two pteromalids, Asaphes vulgaris Wikr., and Pachyneuron aphidis Bch., have been reared in Germany from A. mali. This is reported as the first record of any parasites of A. mali in Europe.

1931

Veitch, R. (156)
Report of the chief entomologist. Queensland Dept. Agr. Ann. Rpt., 1930-31: 43-46.

Aphelinus mali, although effective in controlling the woolly apple aphid in previous years, was not so effective in the past season.

Venables, E. P. (157)
Aphelinus mali Hald., a parasite of the woolly aphis. Ent. Soc. Brit. Columbia Proc. 28: 16-18.

A brief review of the distribution of A. mali into various parts of the world, and a short account of its introduction from Ontario into the Okanagan Valley of British Columbia in 1929.

Werneck, H. L. (158)
Beiträge zur Einfuhrung und Verbreitung der Blutlauszehrwespe Oberösterreich. Gartenbauwissenschaft 5: 360.

Reports the introduction of Aphelinus mali into Austria from France in 1926. It successfully competes with its host in Upper Austria and near Linz.

1932

Childs, L., and Gillespie, D. G. (159)
Production and spread of the woolly aphid parasite, Aphelinus mali, in the Hood River Valley. Jour. Econ. Ent. 25(5): 1013-1016.

Reports the introduction and establishment of A. mali from Michigan into the Hood River Valley and other points in Oregon in 1929. Notes are also given on methods of liberation and on the biology of the parasite.

Kamito, S. (160)
[On the biological control of pests in the countries along the Pacific Ocean.] Oyo-Dobutsugaku Zasshi 4(3): 154-158. [In Japanese]

Aphelinus mali was introduced from Oregon into Japan, and is being reared there.

1932

Kovacevic, Z. (161)
Die Verbreitung von Aphelinus mali in Jugoslavien, Anz. f. Schädlingsk. 8(3): 29-31.

In June 1930, A. mali was introduced from Italy into Jugoslavia, when it was discovered that it was already present there, with from 85 to 90 percent of the aphids parasitized. It had probably been introduced into Jugoslavia on apples from California.

Nicholls, H. M. (162)
The woolly aphis and its parasite. Tasmanian Jour. Agr. 3(3): 99-103.

The origin of the woolly apple aphid and of its parasite, Aphelinus mali, is attributed to America. Since the parasite was introduced into Tasmania a few years ago, it has multiplied to an extraordinary extent and spread considerable distances. Some evidence that it is distributed by the winged aphid in the early stages of parasitism is presented.

Nonell Comas, J. (163)
Aphelinus mali y su difusión en España. Bol. de Patol. Veg. y Ent. Agr. 6(1931, 23-26): 90-97.

Reports the introduction of A. mali into Spain from Uruguay and Italy in 1926. It is now established over a wide area and has proved of great value.

Ripper, W. (164)
Eine neue methode der kolonisation der Blutlauszehrwespe. Gartenbauwissenschaft 6: 682. (Abs. in Pflanzenkrank. 43(7): 427).

Describes how Aphelinus mali was distributed in Italy. Distribution by placing parasitized aphids on twigs in orchards is not satisfactory because of rainy weather. Adult parasites are reared and shipped out and held in storage until the weather is suitable for their release.

Van Poeteren, N. (165)
Verslag over de Werkzaamheden van den Plantenzeiktenkundigen Dienst in het jaar 1931. Verslag. en Meded. Plantenziektenkund. Dienst Wageningen. 66, 143 pp.

Aphelinus mali was distributed in many districts in the Netherlands.

1932

Veitch, R. (166)
Report of the chief entomologist. Queensland Dept. Agr. Ann. Rpt., 1931-32: 51-55.

Aphelinus mali controlled the woolly apple aphid in many orchards.

Ward, F. E. (167)
/Notes on insect pests./ Tasmania Dept. Agr. Ann. Rpt., 1930-31: 41; 1931-32: 41-44.

Liberation of Aphelinus mali was continued in 1931 and 1932.

Weir, Robert (168)
Canada Department of Agriculture. Work of the Entomological Branch during the year ended March 31, 1932. Canada Min. Agr. Rpt., 1931-32: 178.

Aphelinus mali mentioned.

1933

Marlatt, C. L. (169)
Report of the chief of the Bureau of Entomology, 1933. U. S. Bur. Ent. Ann. Rpt., 1933: 3.

Aphelinus mali was shipped to Ecuador.

Massee, A. M. (170)
Notes on insect pests and mites in 1932. East Malling /Kent/ Res. Sta. Ann. Rpt., 1932, 20: 109-116.

Discusses the introduction of Aphelinus mali into several orchards in 1931 and 1932, and its establishment in some of them.

Meier, N. F., and Telenga, N. A. (171)
Ueber biologische Bekämpfung der Blutblattlaus (Eriosoma lanigerum Hausm.) durch ihren Parasit--Aphelinus mali Hald., in USSR. Plant Protect. 1932 (3): 17-24. /Summary in German./

Reports the introduction in 1930 of A. mali into Crimea and North Caucausus with material from Italy. Also discusses the biology of the parasite. It survived the severe winter in the Crimea, and three hyperparasites were reared from it.

1933

Newcomer, E. J. (172)
Orchard insects of the Pacific Northwest and their control. U. S. Dept. Agr. Cir. 270: 69.

Aphelinus mali has been successfully introduced into the Pacific Northwest. (See also 274 and 310.)

Pussard, R. (173)
Observation sur l'acclimatition d'Aphelinus mali Hald. (Hym. Chalcid.) a Saint-Genis-Laval. Soc. Linn. de Lyon Bul. Mens. (2) 2(1): 12.

A. mali was introduced into the Lyons district and other orchards in the neighborhood in June 1932.

Wille, J. (174)
El control del pulgón lanígero del manzano mediante su parásito natural, el Aphelinus mali. [Peru] Inf. Estac. Exp. Agr. Min. de Fomento 19: 6-10.

The discovery of A. mali in Peru in 1930 and its distribution throughout the country is described, together with an account of its biology.

1934

Anonymous (175)
[Report of activities of the Hygienic Institute in Zagreb and organizations dependent on it in 1932.] Socij.-med. Pregl. 5(1-2): 28-60. [In Serbian.]

Reports the introduction and establishment of Aphelinus mali in Zagreb. The woolly apple aphid has been completely eliminated by the parasite.

Bodo, F. (176)
Aphelinus mali im Burgenlande heimlisch? Neuheit. auf dem Geb. des Pflanzenschutz. 27(1): 1-7.

Discusses the introduction of A. mali into the Burgenland from the Tyrol in September 1932 and its establishment 10 miles distant in 1933. Where used, tar distillate sprays seem to destroy the parasite.

1934

Fowler, R. (177)
The use of chemically treated corrugated bands as a supplementary control for codling moth. So. Austral. Dept. Agr. Jour. 38(4): 453-456.

Chemically treated bands placed on apple-tree trunks had caught great numbers of woolly apple aphids while they were migrating to the roots, but there were not so many in 1933-34, as Aphelinus mali had been numerous.

Greenslade, R. M., and Massee, A. M. (178)
Some notes on the woolly aphis parasite (Aphelinus mali Hald.). East Malling [Kent] Res. Sta. Rpt., 1933(21): 225-227.

Describes the introduction and establishment of A. mali into Kent in 1933. It migrated against the prevailing winds and completely eradicated the woolly apple aphid. Tar-distillate and lime-sulfur sprays did not appear to retard the parasite. In another center it was not effective and sprays had to be applied to control the aphid.

Jancke, O. (179)
Zur Ausbreitungsfähigheit der Blutlauszehrwespe Aphelinus mali Hald. Arb. über Physiol. u. Angew. Ent. 1(2): 101-109.

The author discusses the spread of A. mali, particularly in Germany. He believes that reported dissemination of considerable distances is due to man, and not to natural distribution.

Marcovitch, S. (180)
The woolly apple aphid in Tennessee. Tenn. Agr. Expt. Sta. Bul. 151.

Aphelinus mali is often capable of wiping out the aerial forms of the woolly apple aphid.

Marek, ----- (181)
Die biologische Bekämpfung der Blutlaus. Landw., Vienna, 1933: 323-325, illus. (Abs. in Neuheit. auf dem Geb. des Pflanzenschutz. 27(5): 128.)

Aphelinus mali introduced into Austria, survived the winter of 1932-33 in only small numbers, owing to severe winter weather. Those enclosed in a tent around some trees survived much better.

1934

Phaff, S. K. (182)
De bestrijding van de bloedluis in Zeeland. Tijdschr. over Plantenziekten 40(12): 264-272.

Gives an account of the bionomics of the woolly apple aphid in Zeeland and the control measures used against it in Holland and other countries.

Rosenberg, H. T. (183)
A study of the colonization of Aphelinus mali Hald. Roy. Ent. Soc. London Trans. 82(2): 415-420.

Discusses the introduction and successful establishment of A. mali in an apple orchard in the Berkshire district, England.

Schoevers, T. A. C. (184)
De invoer, vestiging en verbreiding van het sluipwespje Aphelinus mali Say, parasiet van de bloedluis in Nederland. Tijdschr. over Plantenziekten 40(12): 273-278.

Reports that the introduction of A. mali into Holland in 1924 has been entirely successful, the parasite having maintained itself over a period of several years and become widely distributed.

Strong, L. A. (185)
Report of the chief of the Bureau of Entomology, 1934. U. S. Bur. Ent. Ann. Rpt., 1934: 4.

Shipments of parasites included Aphelinus mali to Colombia and Costa Rica.

Thompson, W. R. (186)
The development of a colony of Aphelinus mali Hald. Parasitology 26(3): 449-453. (U.S. Off. Expt. Sta., Expt. Sta. Rec. 72: 232).

An account of the development of a colony of A. mali at the expense of its host, the woolly apple aphid.

Warburton, C. (187)
Annual report for 1934 of the zoologist. Roy. Agr. Soc. England Jour. 95: 532-537.

The woolly apple aphid, more abundant than ever, was in some places eradicated by Aphelinus mali.

1934

Yothers, M. A. (188)

Report on the introduction of Aphelinus mali Hald., a parasite of the woolly apple aphid in the Wenatchee, Wash., district. Wash. State Hort. Assoc. Proc. 30(1934): 68-71.

Consignments of A. mali were obtained from Ontario and Oregon in 1931 for the control of Eriosoma lanigerum, in view of its association with perennial canker. In July the parasites were introduced into a large cage constructed around a heavily infested apple tree, and within 60 days their numbers had increased so that 25,500 of their progeny were released. Others were released later, and by 1934 the parasite had checked the aphid in many orchards throughout the district.

1935

Anonymous (189)

Woolly aphis killed by hungry parasite. Yakima, Wash., Fruit Growers' Assoc. "Big Y" Bul. 14(1): 6.

A brief popular discussion of the success of the woolly apple aphid parasite, Aphelinus mali, in controlling the aphid in the Wenatchee, Wash. district, and its spread over 8 to 10 square miles. (See 188).

_____ (190)

Memoria de los trabajos realizados por la Estación de Fitapatología agrícola de La Coruña, año 1934. Galicia Pub. Estac. Fitopat. Agr. 10, 79 pp.

Reports the introduction of Aphelinus mali, from Barcelona into Galicia (Poland) and its successful establishment and redistribution into other districts.

_____ (191)

Insect pests and their control. Agr. Gaz. N. S. Wales 46(7): 394-398.

In most apple orchards the woolly apple aphid is kept under control by the parasite Aphelinus mali.

1935

Aller, Curtis C. (192)
Yakima growers may try aphid parasite. Yakima, Wash., Fruit Growers' Assoc. "Big Y" Bul. 14(3): 2, 3.

Summarizes paper by Yothers (188) giving results of successful introduction of Aphelinus mali into the Wenatchee, Wash., district, and offers supply of the parasite to growers in the Yakima district.

Borg, P. (193)
Report of the plant pathologist. Malta Dept. Agr. Rpt., 1933-34: 3, 43-46.

Aphelinus mali was successfully introduced from Italy into Malta and Gozo in 1933-34 and spread into all orchards.

Císlik, W., and Kawecki, Z. (194)
L'apparition en Pologne de l'Aphelinus mali Hald. Acad. Cracovie Compt. Rend. 9: 5.

In October 1935 A. mali appeared in several districts in Poland without having been artifically introduced.

_____ (195)
Das spontane Auftreten der Blutlauszehrewespe Aphelinus mali Hald. in Polen. Acad. Cracovie Int. Bul. (B 2) 1935 (8-10): 343-345.

The same information as in (194).

Clausen, C. P. (196)
Insect parasites and predators of insect pests. U. S. Dept. Agr. Cir. 346: 11.

In many sections of the country the woolly apple aphid (Eriosoma lanigerum) is successfully controlled by Aphelinus mali.

_____ (197)
[Parasitism of wooly aphid.] In N. Central States Entomological Meeting Rpt., 1935: 3.

The woolly apple aphid, a native of the United States, has become established throughout the country, but in the East it

is kept under control at times by the parasite Aphelinus mali. This parasite did not accompany the aphid in its distribution to the western part of the country, but its introduction into the Hood River Valley of Oregon and the Wenatchee district of Washington, resulted in a large measure of control. It was not due to adverse conditions that the parasite did not become established earlier.

Cottier, W. (198)
Aphides affecting cultivated plants: (4) aphides of the peach, plum, and apple. New Zeal. Dept. Agr. Jour. 51(1): 26-31.

Since the introduction of Aphelinus mali the woolly apple aphid has ceased to be a serious pest.

Deutschmann, F. (199)
Die Blutlauszehrwespe in Südmähren. Ztschr. f. Pflanzenkrank. 45(1): 41-44.

The author reports his introduction of Aphelinus mali into Moravia from Italy in 1933, and states that it has kept the woolly apple aphid in check.

_____ (200)
Die Blutlauszehrwespe in Südmähren. Kranke Pflanze 12(1): 4-6.

Reports the introduction of Aphelinus mali from Italy into southern Moravia in 1933, where it became so abundant that no woolly apple aphids were observed in July 1934.

Jancke, O. (201)
Ueber den Einfluss einiger Blutlaus-Bekämpfungsmittel auf die Entwicklung des Blutlausparasiten Aphelinus mali. Arb. über Physiol. u. Angew. Ent. 2(2): 96-98.

Discusses the results of laboratory tests of sprays upon A. mali. Some preparations would completely destroy the aphid without harming the parasite.

Massee, A. M. (202)
Notes on mite and insect pests for the year 1934. East Malling [Kent] Res. Sta. Ann. Rpt., 1934(22): 165-172.

Aphelinus mali, liberated in the spring of 1933, had become well established by October 1934 and had spread into adjoining orchards.

1935

Nitsche, G. (203)
Die Blutlaus und ihre Bekämpfung. Kranke Pflanze 12(1): 2-4.

A popular account of unsuccessful attempts to control the woolly apple aphid by means of its parasite, Aphelinus mali, in Germany.

Noble, N. S. (204)
The woolly aphid parasite. Effect of orchard sprays on Aphelinus mali. Agr. Gaz. N. S. Wales 46(10): 573-575.

In laboratory tests with various spray materials there was little or no influence on the development of the parasite.

Pescott, R. T. M. (205)
The woolly aphis of the apple (Eriosoma lanigerum Hausm.). Victoria Dept. Agr. Jour. 33(8): 379-382.

Aphelinus mali, introduced into Victoria in 1924-25, usually keeps the woolly apple aphid under control in most orchards. Instructions are given for dealing with consignments of parasitized aphids.

Romanova, V. P. (206)
[Materials on acclimatisation of Aphelinus mali Hald. in North Caucasus.] Plant Protect. 1935(2): 65-76. [In Russian.]

Discusses the effect of climate on A. mali and Eriosoma lanigerum.

Speyer, W. (207)
Die Blutlaus-Schlupwespe im Niederelbischen Obstbaugebiet. Altlander Ztg. Aug. 10, 1935, 1 p. Reprint.

Aphelinus mali, introduced into the lower Elbe fruit-growing district, Germany, prior to 1928, was comparatively rare, but by 1934 it had become thoroughly established. Tar-distillate winter sprays (5 percent) appeared to do it little damage.

Stepanov, E. M. (208)
[The biological method of controlling pests of plants in Abkhazia.] Med. 8vq., 80 pp. [In Russian.]

Reports the biological control of the woolly apple aphid by its parasite, Aphelinus mali, introduced from the Crimea into the Republic of Abkhazia on the Black Sea in 1932. Biological notes are given.

1935

Strong, L. A. (209)
New parasite aids fight on insect pest of fruit. Midwest Fruitman 8(9): 8.

Aphelinus mali as a parasite of woolly apple aphid.

Sweetman, H. L. (210)
The biological control of insects. 461 p., illus. Ithaca, N. Y.

Aphelinus mali, pp. 154-156, 275, 351, 354.

Yakhontov, V. V. (211)
[On Aphelinus mali Hald., a parasite of the woolly apple aphis (Eriosoma lanigerum Hausm.)] Sotziol. Nauka. Tekhn. 3(9): 74. [In Russian.]

A. mali, introduced into Tashkent in 1932, survived the unusually severe winter of 1932-33, and became well established the following season. By 1935 the parasite was found in other orchards several thousand yards away.

1936

Anonymous (212)
Auftreten der Blutlauszehrwespe Aphelinus mali Hald., in Polen. Nachrichtenbl. f. den Deut. Pflanzenschutzdienst 16(8): 79.

It is reported that A. mali has become established in Poland without having been introduced there artifically. It has withstood the Polish winters.

(213)
Rapports sommaires sur les travaux accomplish dans les laboratoires en 1934 et 1935. Ann. des Épipthyt. et de Phytogénét. n. ser. 2(3): 405-422.

It has been difficult to establish Aphelinus mali in some parts of Normandy because the host, the woolly apple aphid, does not appear early enough in the spring to furnish propagation material.

Borg, P. (214)
Report of the plant pathologist. Malta Dept. Agr. Rpt., 1934-1935. liii-lxi.

Aphelinus mali was introduced into Gozo and Malta in 1934 from Italy. Many of the parasites and their hosts, Eriosoma lanigerum, were destroyed during the summer of 1934 by Coccinella septempunctara L.

1936

Chugunin, Ya. V. (215)
/Results of acclimatisation of Aphelinus mali Hald. in the Crimea./ Plant. Protect. 1936(8): 99-103. /In Russian./

Reports the mass breeding of A. mali in Crimea, where it had been successfully introduced in 1933. Liberations over 7,800 acres spread over 14,800 acres, reducing woolly apple aphid infestation by 70 to 80 percent.

Clausen, C. P. (216)
Insect parasitism and biological control. Ent. Soc. Amer. Ann. 29(2): 201-223.

Discusses the relation between chemicals and biological control and reviews the work on this subject by Jancke and by Noble, with reference to Aphelinus mali and its host, the woolly apple aphid.

Della Beffa, G. (217)
Relazione sull'attività del laboratoria e R. Osservatorio di Fitopatologia di Torino nell'anno 1935. 11 pp.

Reports the reintroduction of Aphelinus mali into the Piedmont region and elsewhere during the year.

De Santis, L. (218)
Los parásitos e hiperparásitos Argentinos de los insectos prejudicidales á la agricultura (Hymenoptera). Primera nota. Un parásito de la cochinilla blanca del rosal. Un parásito secondario de los pulgones. Buenos Aires (Prov.) Bol. de Agr. 16(11): 5-15.

The pteromalid hyperparasite, Asaphes vulgaris Wlkr., was not reared from Eriosoma lanigerum, which had been parasitized by Aphelinus mali.

Kawecki, Z. (219)
Blutlaus und Blutlauszehrwespe in Süd-Polen. Ogrodnictwo 1936 fasc. 1, 29 pp., reprint. /In Polish with summary in German./

Parasitism of the woolly aphid by Aphelinus mali in Poland was first observed in 1935. Suggests that it should be liberated in other districts where it does not occur.

1936

Kiwitt, O. (220)

[The acclimatisation of Aphelinus mali Hald. in the North Caucausus.] Plant Protect. 1936(8): 104-108. [In Russian.]

Reports the introduction and successful establishment of A. mali in the southeastern part of North Caucasus in 1933. Survived minimum winter temperatures of 13° F. below zero. In 1935 it was introduced successfully into Daghestan.

Nakayama, S. (221)

[Experiments on the introduction, establishment and utilization of Aphelinus mali Haldem., a parasite of Eriosoma lanigerum Hausm. First Report.] Agr. Expt. Sta. Corea Jour. 8(2-3): 136-149. [In Japanese.]

A. mali was introduced into Korea from Japan in 1934. Sprays have not affected the progress of the parasite. Biological data are given.

Sidorovnina, E. P., and Ismailov, A. (222)

[Summary of the scientific research work of the Institute of Plant Protection for the year 1935.] Roy. 8 vo. 596 pp. [In Russian.]

Discusses the effective establishment and distribution of Aphelinus mali (pp. 313-316) in the different orchard districts in the area of Azerbaijan into which the parasite had been introduced 2 years earlier.

1937

Anonymous (223)

Rapports sommaires sur les travaux accomplis dans les laboratoires en 1936. Ann. des Épiphyt. et de Phytogénét. n. ser. 3(2): 275-290.

Reports the distribution throughout France of Aphelinus mali reared at the Bordeaux station.

(224)

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Diseases, insects, and other pest injuries to plants. Kans. Agr. Expt. Sta. Rpt. 8(1934-36): 90-106.

Aphelinus mali was liberated during the years 1934-36.

1937

Childs, Leroy (225)
[Aphelinus mali.] Better Fruit 32(2): 12.

Insect parasites of the woolly apple aphid have so completely eliminated this insect that it is difficult to find colonies. Spiders sometimes spin webs over pruning wounds and these webs protect aphids from their enemies.

Císlik, W. (226)
Referaty zgoszone ma czwarty letni zjazd Sluzby Ochrany Roślin w dniach 24-30 Czerwca 1937 roku w Krakowie. Rocz. Ochrony. Roślin. 4(3): 135 pp. Co zdzialal osiee korówkowy (Aphelinus mali) w walce z korowka welnista w 1936 r. w Krakowie. pp. 70-71.

Biological notes on A. mali, which is thoroughly established in Poland, where it gives good control of the woolly apple aphid, especially in midsummer.

Dozier, H. L. (227)
Descriptions of miscellaneous chalcidoid parasites from Puerto Rico (Hymenoptera). Puerto Rico Univ. Agr. Jour. 21(2): 121-135.

Three new aphelinids described from other localities are . . . Prospaltella pulchella, which was reared from a shipment of apple twigs infested with the woolly apple aphid imported from Delaware into Haiti in connection with the attempted introduction of Aphelinus mali, and is thought to be a parasite of some coccid on apple.

Greenslade, R. M. (228)
The problem raised by the woolly aphis of the apple. Ann. Appl. Biol. 24(1): 184-187.

Although the woolly apple aphid parasite, Aphelinus mali, has been introduced into almost every apple-growing section in the world, generally with great success, several attempts at getting it established in England have not been so successful, owing to the unfavorable climate. In some orchards it has been entirely successful, and the author concludes that not all factors governing the increase of the parasite are known.

1937

Jary, S. G., and Austin, M. D. (229)
Department of Entomology. [Report 1935-36.] Southeast Agr. Col. Jour. 39: 9-15.

Aphelinus mali has been liberated in two localities in Kent, and appears to be established in both.

Kovacević, Z. (230)
Prilog poznavanju Aphelinus mali. Arh. Min. Poljoprivr. Rpt. 4(6): 19 pp. [With summary in German.]

A. mali Hald., was discovered in Jugoslovia in 1930 and has spread throughout practically the whole country, wherever apples are infested by the woolly apple aphid. Biological data are also given.

Morris, H. M. (231)
Annual report of the Entomologist for 1936. Cyprus Dept. Agr. Rpt., 1936: 40-49.

Aphelinus mali, introduced into Cyprus from England, does not appear to have become established.

Polizu, S. (232)
[The parasite of the woolly aphis in Bessarabia and Bukovina.] Bessarabsk. s.-kh. Vyestn. 1937(6): 7-9. [In Russian.]

An attempt to introduce Aphelinus mali into Rumania in 1923 seemed unsuccessful, but it was found in Moldavia in 1924. In 1936-37 it was giving a high percentage of parasitism in both Bessarabia and Bukovina. Suggests that the parasite may have reached Bessarabia by gradually migrating down the Danube from Jugoslavia. Notes on the biology are given.

Sachtleben, H., and Thiem, H. (233)
Die Aussetzung der Blutlauszehrwespe (Aphelinus mali Hald.) in Berlin-Dahlem und ihre Verbreitung in der Provinz Brandenburg. Arb. über Physiol. u Angew. Ent. 4(4): 297-321.

Sachtleben (pp. 297-299) describes the introduction of A. mali into the Berlin-Dahlem district in 1928 with material from Italy. Thiem (pp. 299-321) reports that the parasite is present in various parts of Germany, in some of which it was liberated in 1924-35.

1937

Serdyukov, P. (234)
[Results of widespread distribution of Aphelinus mali as a means of control of Eriosoma lanigerum in the North Caucasus.] Plant Protect. 13: 69-71. [In Russian.]

A. mali has been established in the Caucasus. It does not prevent the woolly apple aphid from becoming abundant in the spring but destroys almost all of them during the summer, increasing the yield of apples.

Speyer, W. (235)
Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade.... vom. 1, April 1936 bis 31. März 1937. Altländer Obst. u. Landw. 49, Rpt. 59, 4 pp.

Although Aphelinus mali is well established and destroys many of the woolly apple aphids, other control measures cannot be disregarded.

Venables, E. P. (236)
Further notes on the woolly aphis parasite Aphelinus mali Hald. Ent. Soc. Brit. Columbia Proc. 34: 33-35.

Reports the successful introduction and establishment of A. mali in the Okanagan Valley, British Columbia. Large numbers of the parasite were reared in large cages during the 4 years following its initial introduction, 1929. The abundance of the parasite and its host appears to be influenced by the same factors. Biological data are also included.

Wakeland, C. (237)
Entomology. Idaho Agr. Expt. Sta. Bul. 221: 30-31.

Aphelinus mali was established in 1936 in an experimental apple orchard into which it had been introduced in 1935.

1938

Anonymous (238)
Plantesygdomme i Danmark 1937. Tidsskr. Planteavl 43: 222-278. [Abs. in (Denmark) Oversigt Statens Plantepatologiske Forsog 54.]

Notes the introduction of Aphelinus mali into Denmark, and hopes that it will control the woolly apple aphid, which is not generally distributed throughout the country.

1938

Ballard, E. (239)
Report of the chief of plant protection officer for the year ended 31st March 1938. Palestine and Forests Dept. Agr. Rpt., 1937-38, 71-73.

Aphelinus mali was introduced into Palestine from Egypt in 1937.

de Nardo, A. (240)
Annual report of the working of the department of agriculture (Malta) during 1936-37. 77 pp.

Eriosoma lanigerum was well controlled in all apple orchards by Aphelinus mali.

Dumbleton, L. J., and Jeffreys, F. J. (241)
The control of the woolly aphis by Aphelinus mali. New Zeal. Jour. Sci. and Technol. 20(3): 183A-190A.

Discusses the percentages of parasitism in the field by A. mali, and gives biological notes on factors influencing control of woolly apple aphids.

Evans, J. W. (242)
Aphides and their control. Tasmanian Jour. Agr. 9(1): 20-23.

Eriosoma lanigerum is now of little importance owing to the establishment of Aphelinus mali.

Meier, N. F. (243)
[The biological method of controlling injurious insects and the results of its application in the USSR. (With the addition of material on the races of Trichogramma.)] Zool. Zhur. 17(5): 905-932. [In Russian.]

Reports the results of work in the Russian Union since 1930, including the successful establishment of Aphelinus mali. Discusses the effect of temperatures on the activities of the parasite.

Morris, H. M. (244)
Annual report of the entomologist for 1937. Cyprus Dept. Agr. Rpt., 1937: 42-47.

Aphelinus mali, introduced into Cyprus in 1936, was present in one apple orchard in 1937.

1938

Nonell Comas, J. (245)
Introducion y diffusion del Aphelinus mali (Hald.) in Espana. Bol. de Patol. Veg. y Ent. Agr. 8: 179-186.

A survey of the distribution in Spain of A. mali parasitising Eriosoma lanigerum.

Ruszkowski, J. (246)
Rozmiezczenie wystepowania korówki welnistej w Polsce w 1936 i 1937. Rocz. Ochrony Roslin 5(4): 123-128.

Aphelinus mali, which has established itself in some parts of Poland, has also been introduced into Silesia from England and Barcelona and liberated in about 34 localities, in some of which it is very active.

Toyoshima, A. (247)
[Studies on Aphelinus mali Hald., a parasite of Eriosoma lanigerum Hausm.] Apple Expt. Sta., Aomori Pref., Rpt. 1, 23 pp., illus. [In Japanese.]

A. mali was introduced into Aomori Prefecture from Oregon (U.S.A.), in 1931, and has become well established in the orchards. Biological observations are included.

1939

Anonymous (248)
Memoria de los trabajos realizados por la Estacion de Fitopatologia Agricola de la Coruña, años 1937-1938. Publ. Estac. Fitopat. Agr. Galicia 13, 40 pp.

The distribution of Aphelinus mali against Eriosoma lanigerum was continued in 1937 and 1938.

(249)
The woolly aphid (Eriosoma lanigera). Palestine Monthly Agr. Bul., 1939: 20-23.

Aphelinus mali, introduced from Egypt into orchards in the Judean Hills in Palestine, has practically eliminated the woolly apple aphid there. Parasitism of infested roots is said to be very restricted.

1939

Baird, A. B. (250)
Biological control of insect pests in Canada with special reference to the control of the European spruce sawfly, Gilpinia polytoma Htg. Ent. Soc. Ontario Ann. Rpt. 70: 51-56.

The woolly apple aphid parasite, Aphelinus mali, transferred from Belleville, Ont., in 1929, has reduced its host and proved of tremendous value to the Okanagan growers.

Clausen, C. P. (251)
Some phases of biological control work applicable to sugarcane insect problems. Internatl. Soc. Sugar Cane Technol. Cong. Proc. 6: 421-426.

Many native parasites and predators are very limited in distribution, although conditions are favorable for them over a wide area, in which they can be successfully liberated. Parasites that have been used in this way in the United States are Aphelinus mali, against the woolly apple aphid.

Cox, J. A. (252)
A preliminary report on the woolly aphids of apple and hawthorn. Jour. Econ. Ent. 32(4): 477-483.

Aphelinus mali was not reared from Eriosoma crataegi Oestl. in field collections and would not attack this species when caged in the field or in the laboratory. Infestations of E. lanigerum on hawthorn were often located by observing parasitized individuals.

Haegele, R. W. (253)
[Aphelinus mali Hald.] Idaho Univ. News Let. 22: 3.

Liberations of the woolly apple aphid parasite were made in the orchard at Parma during 1935 and 1936. It seemed to establish itself readily, for in the fall of 1936 practically all the exposed woolly apple aphids were parasitized. The effectiveness of this parasite in Washington and Oregon is noted, with the hope that it will be equally effective in Idaho.

Lundie, A. E. (254)
The apple grower's insect ally. Farming in So. Africa, 1939, Rpt. 92, 5 pp.

A brief review is given of the distribution of Aphelinus mali throughout the world from original sources in the United States. It was introduced into Sough Africa in 1920, and is now so effective where the woolly apple aphid is present that spraying is unnecessary in most orchards.

1939

Morris, H. M. (255)
Annual report of the Entomologist for 1938. Cyprus Dept. Agr. Ann. Rpt., 1938, 5 pp.

Aphelinus mali is now well established in one orchard in which it was liberated in 1936, and has been distributed from this area to others.

Rahman, K. A. (256)
Short notes and exhibits. Indian Jour. Ent. 1(3): 93-99.

Aphelinus mali, introduced into the Punjab from England in 1937, is well established in the Kulu Valley and on the Simla Hills and has given satisfactory results. It has about 14 generations a year.

Staniland, L. N., and Beaumont, A. (257)
Department of Plant Pathology. Fifteenth Ann. Rpt. for the year ending Sept. 30, 1938. Seale-Hayne Agr. Col. Pam. 49, 39 pp.

Although original liberations of Aphelinus mali had not appeared promising, after several years the woolly apple aphid was almost entirely absent, owing to this parasite.

Whittaker, E. C. (258)
Protect the woolly aphis parasite. Treatment of prunings important. N. S. Wales Agr. Gaz. 50(9): 505-506.

Recently Aphelinus mali has not given control of the woolly apple aphid until late in summer, probably because the overwintering parasite in its host is removed in pruning, or because of the use of oil sprays in winter and nicotine and lime-sulfur sprays in spring. Prunings should be stored until blossom time or later, and then placed in the trees for emergence of the parasites.

1940

Anonymous (259)
[Aphelinus mali Hald.] Cawthron Inst. Sci. Res. Ann. Rpt., 1939, 34 pp.

Discusses the biological experiments and studies of the woolly apple aphid and its parasite, A. mali, in the Nelson, New Zealand, district. Cold winter weather killed both the aphid and its parasite.

1940

Anonymous (260)
Some common insect pests of fruit trees and vines in South Australia. Part II. Sucking insects. So. Austral. Dept. Agr. Jour. 43(9): 633-646.

Recommends that Aphelinus mali be introduced into woolly apple aphid infested orchards to control this pest on the parts of the trees above ground.

_____ (261)
Review of the year 1939. Plant Protection. Palestine Monthly Agr. Bul., Jan. 1940: 64-65.

Chemical measures were required to supplement the control of the woolly apple aphid by Aphelinus mali.

Clausen, C. P. (262)
Entomophagous insects. 688 pp., illus. McGraw-Hill, New York.

Aphelinus mali, p. 157, 159, 166, and 168.

Ehrenhardt, H. (263)
Untersuchungen über den Einfluss der Zehrwespe Aphelinus mali auf den Massenwechsel der Blutlaus unter Berücksichtigung der biologischen Bekämpfung der Blutlaus. Arb. über Physiol. u. Angew. Ent. 7: 1-41. (Abs. in Ztschr. f. Pflanzenkrank. 52(11): 524-525.)

Reports the introduction and spread of A. mali in orchards in the Lower Elbe. Discusses biological data and the probable means as to its rapid spread over great distances.

Faes, H. (264)
Station fedérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rap. Ann., 1938. Landw. Jahrb. des Schweiz 54(1): 1-26.

Eriosoma lanigerum on apple was eliminated in the autumn by Aphelinus mali in the Domaine de Pully.

1940

Graf Marin, A., and Cortes Peña, R. (265)
Introducción de hiperparásitos en Chile; resumen de las importaciones hechas y de sus resultados. Sixth Pacif. Sci. Cong. Proc. 1939(4): 351-357.

Aphelinus mali was successfully introduced into Chile in 1921-22. It is fairly successful in controlling the woolly apple aphid, especially in the season.

Ishii, T. (266)
The problems of biological control in Japan. Sixth Pacific Sci. Cong. Proc. 1939(4): 365-367.

Aphelinus mali, introduced into Japan from Oregon, gives effective control against the woolly apple aphid.

Newcomer, E. J. (267)
Natural dispersion of Aphelinus mali (Hald.). Jour. Econ. Ent. 33(5): 811.

Reports three localities where A. mali had spread several miles from other sources of infestation.

Wille, J. E. (268)
Memoria de la estación experimental agrícola de La Molina correspondiente al año 1939. [Peru.] Min. de Fomento. Agr. Expt. Estac. Mem. 12(24), 371 pp.

The distribution of Aphelinus mali was continued against Eriosoma lanigerum on apple.

1941

Anonymous (269)
Memoria de los trabajos realizados por la Estación de Fitopatología Agrícola de La Coruña, años 1939-40. Estac. Fitop. Agr. Coruña Pub. 14, 54 pp.

Since 1934, 657 colonies of Aphelinus mali have been liberated against Eriosoma lanigerum in over 80 percent of the apple-growing districts. The results have ranged from complete eradication, sometimes followed 3 to 4 years later by reinfestation, to total failure, which is often due to unfavorable weather immediately after liberation. In most places, however, there has been a considerable and permanent reduction in infestation.

1941

Anonymous (270)
Insect pests. Agr. Gaz. N. S. Wales 53(1): 33-37.

Reports that Aphelinus mali is now distributed throughout the State and exercises good control of the woolly apple aphid. Discusses the effect of sprays on the parasite.

Annand, P. N. (271)
Report of the chief of the Bureau of Entomology and Plant Quarantine, 1941. U. S. Bur. Ent. and Plant Quar. Ann. Rpt. 1941: 98.

Aphelinus mali was shipped to Ecuador and Venezuela.

Castberg, C. (272)
Nya rön angaende blodlusen. (Sweden) Växtskyddsnotiser 1941(6): 86-90.

In spite of the cold winter of 1940-41 in Sweden, the young nymphs of the woolly apple aphid survived in cracks in the bark of apple trees, although older individuals did not. Aphelinus mali, which has been introduced into Sweden, has been able to survive the cold winters, but has not been generally effective in controlling the woolly apple aphid.

De Santis, L. (273)
Lista de himenópteros parásitosy predatores de los insectos de la República Argentina. Brasil. Agron. Soc. Bol. Rpt. 4(1): 66 pp.

New host records for parasites in Argentine include Aphelinus mali, from Aspidiotus hederae Vall.

Jancke, O. (274)
Stand der chemischen und biologischen Bekämpfung der Blutlaus. Kranke Pflanze 18: 26-29.

States that Aphelinus mali does not effectively control the woolly apple aphid in Germany and that chemical control is therefore necessary.

1941

Newcomer, E. J. (275)
Orchard Insects of the Pacific Northwest and their control. U. S. Dept. Agr. Cir. 270: 25-69, illus. Revised.

States that the successful establishment of Aphelinus mali in the Pacific Northwest makes spraying for the control of the woolly apple aphid unnecessary in many apple orchards. (See also 172 and 310.)

Rahman, K. A., and Abdul Wahid Kahn, M. (276)
Observations on Aphelinus mali Hald. in the Punjab. Indian Jour. Agr. Sci. 2(3): 446-450.

A. mali was introduced and became established in the Kulu Valley (Punjab). Females refused to oviposit in 13 other species of aphids offered them, but a single female parasitized up to 220 woolly apple aphids. Twigs containing parasites should be saved away from trees that are to be sprayed with oil.

Speyer, W. (277)
Untersuchungen über tierische Obstschädlinge und ihre Bekämpfung. Mitt. Biol. Reichsanst. 63: 78-79. (Abs. in Ztschr. f. Pflanzenkrank. 52(2-4): 239.)

In Poland the parasitism of the woolly apple aphid by Aphelinus mali did not exceed 68 percent, since the parasite requires more warmth than does the host.

(278)
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Untersuchungen über tierische Schädlinge und irhe Bekämpfung. Mitt. Biol. Reichsanst. 65: 69-70. (Abs. in Ztschr. f. Pflanzenkrank. 52(12): 554.)

The woolly apple aphid and its parasite were reduced to almost negligible numbers by the cold in the Lower Elbe district in the winter of 1939-40.

Talhouk (Abdul Mon'im S.) (279)
The insect fauna supported by the apple and pear trees in Lebanon. Ent. Rec. and Jour. Variation 53(12): 125-128.

Eriosoma lanigerum, unlike its parasite, Aphelinus mali, is not affected by the hot, dry desert winds in spring, and attacks apple severely until the parasite becomes abundant in the autumn and keeps it in check.

1941

Wille, J. E. (280)
13a memoria de la estación experimental agrícola de La Molina correspondiente al año 1940. La Molina Agr. Expt. Sta. Rpt., 1940(7), 321 pp.

The distribution of Aphelinus mali against the woolly apple aphid in Peru was continued.

1942

Anonymous (281)
[Aphelinus mali.] Imp. Council Agr. Res. Ann. Rpt., 1940-41 (2), 190 pp.

A. mali has become well established in the Kulu Valley and the Simla Hills.

_____ (282)
14a memoria de la estación experimental agrícola de La Molina correspondiente al año 1941. La Molina Agr. Expt. Sta., 1941 (6), 276 pp.

Aphelinus mali, introduced for the control of Eriosoma lanigerum, has become established in Peru.

Annand, P. N. (283)
Report of the chief of the Bureau of Entomology and Plant Quarantine, 1942. U. S. Bur. Ent. and Plant Quar. Ann. Rpt. 1942: 50.

Aphelinus mali was shipped to Bolivia.

Cherian, M. C. (284)
Our present position with regard to the control of fruit pests. Madras Agr. Jour. 30(1): 14-17.

Aphelinus mali showed 40-percent parasitism of the woolly apple aphid at the beginning of the season in apple orchards on the hills of India.

Singh, R. N. (285)
Control of the woolly aphis (Eriosoma lanigerum Hausmann) by spraying and other methods. Indian Jour. Agr. Sci. 12(4): 588-602.

1942

Aphelinus mali, introduced some time ago into the Kumaun district of India, does not appear to offer effective control of the woolly apple aphid, owing to the presence of the coccinellid. It has, however, given considerable control in the Punjab.

1943

Annand, P. N. (286)
Report of the chief of the Bureau of Entomology and Plant Quarantine, 1943. U. S. Bur. Ent. and Plant Quar. Ann. Rpt. 1943: 25.

Aphelinus mali was shipped to Mexico.

Sachtleben, H. (287)
Die biologische Bekämpfung und ihre praktische Bedeutung in Deutschland. Ztschr. f. Pflanzenkrank. 53(1-3): 86-93.

The only known case of successful biological control of an insect pest in Germany by an introduced insect is that of the woolly apple aphid by Aphelinus mali.

1944

Annand, P. N. (288)
Report of the chief of the Bureau of Entomology and Plant Quarantine, 1944. U. S. Bur. Ent. and Plant Quar. Ann. Rpt. 1944: 24-25.

Aphelinus mali was released in Iowa.

Massee, A. M. (289)
Further notes on the woolly aphid parasite (Aphelinus mali Hald.). East Malling [Kent] Res. Sta. Ann. Rpt. 1943: 65-67.

An account of attempts to establish A. mali in four places in Kent from 1924-38, to control the woolly apple aphid. In 1942-43 the parasite was giving complete control in one district and was abundant in two others. On account of the damp, unfavorable weather, it is proposed to store the parasite on twigs overwinter, either indoors at 37° F. or in dry storage.

1944

Michelbacher, A. E., and Borden, A. D. (290)
Two introduced insects attacking the woolly apple aphid in California. Jour. Econ. Ent. 37(5): 715-717.

Reports the introduction of Aphelinus mali into the Watsonville district of California from material supplied by E. J. Newcomer, of the Bureau of Entomology and Plant Quarantine, Yakima, Wash.

1945

Massee, A. M. (291)
Overwintering of the woolly aphid parasite (Aphelinus mali Hald.) in low-temperature apple stores. East Malling [Kent] Res. Sta. Ann. Rpt. 33(1945): 142-143.

A. mali introduced into England may die out, owing to damp winters, therefore tests were made to carry it over winter in cold or dry storage. Cold storage was successful, but dry storage failed. Collecting the parasite in October, keeping it at a constant temperature of 39° to 46° F. until the end of May, and then allowing it to emerge in infested orchards was satisfactory.

Smith, J. Harold (292)
Useful parasitic insects. Queensland Agr. Jour. 61(6): 340-351. (Biol. Abs. 20: 1, 751.)

Aphelinus mali listed as one of the beneficial insects.

1946

Mason, F. R. (293)
[Woolly aphid parasite.] Palestine Dept. Agr. and Fisheries Ann. Rpt., 16 pp., March 31, 1945.

Eriosoma lanigerum is successfully controlled by Aphelinus mali.

Newcomer, E. J., Dean, F. P., and Carlson, F. W. (294)
Effect of DDT, xanthone, and nicotine bentonite on the woolly apple aphid. Jour. Econ. Ent. 39: 674-676.

Prior to the introduction of Aphelinus mali, the woolly apple aphid was a serious pest; now it is relatively insignificant. The use of DDT, however, for codling moth control appears to interfere with the normal activity of the parasite, resulting in a serious increase in aphid population.

1946

Wason, E. J. (295)
DDT as a codling moth control. Experiments with apples on Murrumbidgee Irrigation Area. Agr. Gaz. N. S. Wales 57, pt. 8: 427-431.

Eriosoma lanigerum was present on most of the trees at the beginning of the season, but Aphelinus mali had been active during the winter and exerted marked control.

1947

Bodenheimer, F. S. (296)
Studies of the physical ecology of the woolly apple aphis (Eriosoma lanigerum) and its parasite, Aphelinus mali, in Palestine, Palestine Agr. Res. Sta. Bul. 43, 20 pp., Rehovot.

A comprehensive review of investigations on the bionomics of E. lanigerum and its introduced parasite, A. mali, on apple at Kiryath-Anavim, near Jerusalem, in 1937-40.

Borg, A. (297)
Om blodlusens övervintring 1946-47. [Sweden] Växtskyddsnotiser 1947(6): 81-85.

Discusses the effect of low winter temperatures of 1946-47 in Sweden upon the woolly apple aphid and its parasite.

Childs, Leroy (298)
Progress report on the use of DDT as a codling moth spray. Wash. State Hort. Assoc. Proc. 42: 39-54.

Discusses the relation of the woolly apple aphid to perennial canker. Before the station introduced the woolly apple aphid parasite into Oregon in 1928, the disease had become so serious that many growers despaired of saving their orchards. The introduction of Aphelinus mali not only controlled the aphid but the canker as well. DDT, which is largely nondestructive as a woolly apple aphid spray, destroys the parasites.

Gayford, G. W. (299)
In the orchard. Winter pest control. Victoria Dept. Agr. Jour. 44(6): 272-273. (Biol. Abs. 21: 1001.)

The woolly apple aphid is usually controlled by Aphelinus mali.

1947

Kemp, K. H. (300)
Codling moth control. So. Austral. Dept. Agr. Jour. 51(1, 4, 5): 6-9, 184-186, 220-236, 238.

The woolly apple aphid is normally parasitized by Aphelinus mali.

Miller, L. W. (301)
The biological control of insect pests in Tasmania. Tasmanian Jour. Agr. 18: 117-119.

Aphelinus mali is well established in all apple-growing sections of Tasmania, and in some it is so effective that spraying is unnecessary.

Newcomer, E. J. (302)
Growers' results with DDT for codling moth control. Wash. State Hort. Assoc. Proc. 42: 55-59.

The woolly apple aphid was more common in orchards sprayed with DDT than in orchards not sprayed with it because of the destruction of Aphelinus mali by the DDT. In orchards sprayed two or more times with it, an average of only 9 percent of the aphids were parasitized, as compared with nearly 70 percent where lead arsenate or cryolite was used.

O'Neill, W. J., and Lipovsky, L. J. (303)
The results of experiments with DDT on apples at Wenatchee. Wash. State Hort. Assoc. Proc. 42: 61-65.

When DDT is used, the woolly apple aphid may increase and become a major pest, as it was before Aphelinus was established.

Steiner, L. F., Summerland, S. A., McAllister, H. J., and Fahey, J. E. (304)
DDT for control of codling moth in the Middle West. Indiana Hort. Soc. Trans. (1946) 86: 1-13; Colo. Hort. Soc. Trans. 1946: 113-133.

In the Vincennes area, in all tests since 1943, DDT resulted in almost complete control of this pest, despite the presence of numerous colonies on adjacent trees sprayed with lead arsenate. However, in the orchards south of Vincennes, in Kentucky and Tennessee, minor outbreaks frequently occurred where DDT

1947

had been used. During the application of sprays no aphids parasitized by Aphelinus mali could be found, although within a few weeks after the last DDT spray this parasite had almost completely annihilated aerial colonies of the woolly apple aphid in these orchards.

Yothers, M. A. (305)
DDT and the woolly apple aphid parasite (Aphelinus mali). Jour. Econ. Ent. 40(6): 934.

In orchards where DDT was used to control the codling moth, the woolly apple aphid parasite was unable to maintain its outstanding control of the aphid, and it will hereafter probably be necessary to substitute spraying for biological control.

1948

Bevienn, P. (306)
Plantesygdomme i Danmark 1945-46. Tidsskr. for Planteavl 51: 373-437; 52: 236-292. [Also in Aarsovers. Plantepat. Forsog. 62-63.]

Reports the spread of both Eriosoma lanigerum and its parasite on apple in Denmark.

Bishopp, F. C. (307)
Large-scale insect control problems. Soap 24(2): 143-145, 169.

Woolly apple aphid build-up where DDT is used is associated with the destruction of the aphid's enemies, especially the parasite Aphelinus mali on apple in Denmark.

May, A. W. S., and Fisher-Webster, K. (308)
Codling moth control experiments, 1947-48. Queensland Agr. Jour. 67: 143-146.

Aphelinus mali destroyed most of the woolly apple aphids in small infestations on experimental trees.

1948

Wason, E. J., and Lloyd, N. C. (309)
Insect pests. DDT and codling moth control. Agr. Gaz. N. S. Wales 59: 538-540.

Applications of DDT after mid-December are undesirable if the woolly apple aphid is present, because Aphelinus mali does not become active until after late in December, and early use of DDT allows the parasite to build up to insure effective woolly apple aphid control in the fall. Recommends saving prunings from several parasitized aphid-infested trees when dormant oil sprays are to be applied.

1950

Newcomer, E. J. (310)
Orchard insects of the Pacific Northwest and their control. U. S. Dept. Agr. Cir. 270: 17, 18, and 55. Revised.

Substantially the same as reference 275.

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